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The Breeding Biology of the Forest Wagtail, *Motacilla indica* Gm.[1]

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(*With four plates*)

INTRODUCTION

The Forest Wagtail, *Motacilla indica* Gm., the most peculiar member of the family Motacillidae, is well known in India as a winter visitor but very little has been published about the breeding biology of this interesting bird. During her two expeditions to Amurland the authoress has had a welcome opportunity of studying the Forest Wagtail during its breeding season. The present article, based for the most part on observations made by the authoress, cannot be considered as a detailed monograph as the observations were made simultaneously with numerous other duties.

RANGE

For want of the necessary information the range of the Forest Wagtail cannot be exactly delimited. In the Soviet Union the Forest Wagtail inhabits only the south-eastern part of the country. It is widely distributed in Amurland in the narrow belt of oak forests

[1] Communicated by Dr. Sálim Ali.

along the Amur River, extending eastward from Kumara village 51° 36′ N., 126° 41′ E., (see Neufeldt, 1960) to the east of the city of Khabarovsk. In Ussuriland it is known in nearly all the districts of the Ussuri plain and in the Khanka Lake depression; also in the suburbs of Vladivostok (the Muraviev-Amurski peninsula) and Askold Island and, lastly, from the south-eastern foothills of the Sikhote-Alin Range northward to Tetyukhe village (Shulpin, 1931a; Spangenberg, 1949, Vorobiev, 1954). Gizenko (1955) recorded it in the south-eastern part of Sakhalin Island, north of the town of Starodubsk (approximately 47° 25′ N.).

In the Korean peninsula the Forest Wagtail is distributed in all suitable biotopes (Austin, 1948). In China this bird occurs in the north-eastern provinces (Manchuria) and in the provinces of Hopei (Kansu) and Anhwei (La Touche, 1930; Wilder, 1938). The distribution range shown on the map in Cheng's LIST OF CHINA BIRDS (1958) includes also the provinces located south of the Yangtse River: Chekiang, Kiangsi, and Human, but the authority for this is unknown.

It is not at all certain whether any separate breeding range exists in India. Stuart Baker (1926) includes Assam and adjacent parts of Burma within the range of the Forest Wagtail, because of two nests of the bird received by him from N. Cachar. The authenticity of these two nests is evident from the detailed description published by Stuart Baker (1934), but no more records come from that region. Furthermore, Smythies (1953) pointed out that this species is not to be found in summer in the northern parts of Burma. For this reason I agree with C. Vaurie (1959) in considering these cases of the breeding of this bird as exceptional.

Everywhere within its breeding range the Forest Wagtail is a migratory species, wintering in S. Asia. Only in mild winters it stays the year round in S. Korea (Austin, 1948). In winter it is common in SE. China in the provinces Kwangsi, Kwantung, S. and W. Yunnan, and Hainan Island (Caldwell & Caldwell, 1931). It is recorded as a rather rare bird from the Riu-Kiu Islands (Kuroda, 1933), winters in all the countries of Indo-China, and is well known from the plains of S. Burma (Smythies, 1953) and Thailand (Deignan, 1945). According to Jerdon (1863), Stuart Baker (1926), Sálim Ali (1953) it has been recorded nearly everywhere in Hindustan east of a line drawn from the Sutlej Valley to the Gulf of Cambay. It has been regularly observed in Mysore, Travancore, and Cochin, and along the Malabar coast to the northern extremity of the Western Ghats. More sporadically the Forest Wagtail occurs in other parts of the peninsula. Since it is absent from the Eastern Ghats, Sálim Ali (1953) thinks

that the Forest Wagtail probably reaches its winter quarters in SW. India and Ceylon by way of the Andamans[1]. Ceylon is the south-western extremity of the winter range of the species, where the birds were recorded sporadically in many parts of the island. The winter quarters of the Forest Wagtail are known also from the Andamans, the Malay peninsula, and the adjoining islands such as Penang, Singapore, etc. (Robinson, 1927), and from a number of islands of Malaysia, namely Sumatra, Java, Borneo, and others (Legge, 1880; Kuroda, 1933; Delacour, 1947). In N. Philippines, many islands of Japan, and in some provinces of China (Hupeh, Fukien, Szechwan, and N. Yunnan) it is a straggler only (Caldwell, 1931; Delacour, 1946; Anonymous, 1958).

The Spring Arrival

The spring movement of the Forest Wagtail from its winter quarters to the breeding range starts in March. The birds leave the Malay peninsula in the middle of March; a little later date has been recorded for their departure from the northern parts of the peninsula (Robinson, 1927). Forest Wagtails leave Ceylon about the end of March (Legge, 1880). The latest spring records of these birds in Burma were made at Martaban Bay on May 1st (Hume & Davison, 1878), and in Thailand near Doi Langka on May 2nd (Deignan, 1945). According to data obtained in different parts of India, Forest Wagtails leave the country in May. And the same can be said of S. China: Kwantung, Kwangsi, W. and S. Yunnan (Caldwell & Caldwell, 1931).

From what has been said above it is evident that the distances between the two seasonal areas are not very great, and the main routes of migration are within the limits of the winter and summer areas of the species.

Forest Wagtails arrive rather late at their breeding places (in the first half of May) and all within a very short space of time. In Nanking (China) Forest Wagtails were recorded in 1944 on 30th April and in 1946 on 3rd May (Hoffman, 1952). In N. China (Hopei) their arrival was noticed at the middle of May (Shaw, 1936), in Peking in 1946 on 22nd May and in 1947 on 18th May (Hoffman, 1952). Among the birds listed by Austin (1948) from Korea the earliest birds were taken in Kyonggi Do province on May 2nd and in the more

[1] Recently it has been recorded on passage near Madras in both spring and autumn (Sanjeeva Raj, *J. Bombay nat. Hist. Soc.* **57** : 220 ; **58** : 269).

north-western Pyongan Pukto province on May 9th. In the collection of the Zoological Institute of the Academy of Sciences of the USSR in Leningrad there are the skins of birds collected near Blagoveshchensk (Amurland) on May 12th.

In a tardy cold spring the arrival can be delayed to the end of May. For instance, in 1945 the first Forest Wagtails were noticed in a region of the Kedrovaya River (Ussuriland) only on 25th May (Vorobiev, 1954). This was also the case in 1959 on the upper Amur; in that year the first small flock of Forest Wagtai's was recorded by the authoress near Simonovo village (NW. of Blagoveshchensk) on 26th May. The weather was cloudy with short periods of clear sky and there was a weak north-east wind. The night temperature went down to 3 or 4° C. below zero, and during the day rose to +8° C. or more. On arrival the birds settled on the ground and on trees in a thin Dahurian Birch (*Betula dahurica*) forest which had been burnt that spring. They did not sing but flew from one place to another uttering a very characteristic *ping-teng*. Next day (27th May) the birds were very common in oak forests on the plateau. The arrival of the Forest Wagtails in forests of the upper Amur in 1959 coincided with the time when oaks were covered with young leaves and small fresh leaves began to come out on Dahurian birches. Many birds living in the same biotopes as Forest Wagtails had already arrived and occupied their nest-territories. They were: Spotted Tree Pipits (*Anthus hodgsoni*), Yellowbacked Flycatchers (*Muscicapa narcissina*), Grey Minivets (*Pericrocotus divaricatus*), Needletailed Swifts (*Hirundapus caudacutus*), and Owlets (*Otus sunia*).

During migration Forest Wagtails prefer to keep in forest biotopes of different kinds, but at that period there is much more possibility than at other times to meet them out of forests. On the Amur-Zeya plateau the incoming birds keep in very sparse and light parts of the forests. In particular they readily occupied the parts of forests where recently (approximately one month ago) a forest fire had taken place and where the forest litter and dry twigs were burnt by fire. Just after arrival, Forest Wagtails could be seen in small flocks of 15-20 birds usually in the outskirts of a forest, or near rides and forest roads. They spent nearly all the clear portions of the day on the ground, running in the short spring grass in search of food. On being disturbed they would fly to the lower branches of the trees and there continue their pursuit of insects. The males were extremely animated and sang intensively from 27th May. It seemed that in these noisy flocks females were absent till at least the end of May.

Unfortunately, owing to the absence of sex dimorphism in the coloration of the plumage and the calls of these birds, it was impossible to judge about the sex ratio in the early spring flocks of Forest Wagtails.

Breeding Biotope

In Amurland the males usually secure their nest-territories by the end of May. As a rule the nest-territory is a part of the territory where the flocks of feeding birds stayed after their arrival from the south. In the region we have explored, only some of the Forest Wagtails were migrants. At the beginning of June the difference between the local birds, which had had nest-territories, and the migrant ones was especially noticeable. In 1959 before 6th June no migrant birds had left. The relations between the local birds and the migrants were absolutely peaceful; so also between the local Forest Wagtails themselves, and between the Forest Wagtails and other small passerine birds breeding near by. No sign of quarrelling was noticed. It was only when man or any large animal intruded into the nest-territory that the male and female raised an alarm. In the upper Amur area, which is nearly the north-western limit of the range, the density of the Forest Wagtail population in suitable biotopes was rather high. For instance, on the narrow strip of the Amur-Zeya plateau covered with oak forests (approximately 3 sq. km.) six pairs of breeding Forest Wagtails were recorded in June 1959, the least distance between the nests noticed being 250-300 m. The territory occupied by each pair was not large; on the contrary the territories were often close to each other or even overlapped. An observer standing near one nest could see one or two other nests and hear simultaneously as many as four singing males. Forest Wagtails are very attached to their territory, which is not only their breeding place but is also the main feeding biotope from the time of pair formation till the nestlings leave their nests.

Forest Wagtails are real forest birds. In the south-western portion of the Amur-Zeya plateau these birds breed mainly in the Mongolian Oak forests, and show a preference for Mongolian Oak with underbrush of Lespedeza or of Lespedeza and Dahurian Rhododendron. Such oak-groves usually occupy flat elevations on the plateau (approximately 280-300 m. above sea-level). This is the north-western limit of the range of the Mongolian Oak, and the trees here are poorly developed. The oldest are only 140-150 years old and are never

taller than 25-27 m. More typical of this part of the plateau are trees 10-12 m. in height, with a trunk diameter of 20-25 cm., and a badly-developed crown; most of the branches extend horizontally, the lowest a short distance above the ground. Admixture of other kinds of trees in the oak-groves is insignificant. More common are birches (*Betula dahurica*), larches (*Larix dahurica*), and sometimes pines (*Pinus sylvestris*). The trees stand far from each other, and the forest looks like an orchard. The underbrush comprises mainly low bushes (70-100 cm.) of Lespedeza (*Lespedeza bicolor*). Here and there, thickets of the Dahurian Rhododendron (*Rhododendron dahurica*) of 1-1.5 m. height are common too. Solitary bushes of the hazel (*Corylus heterophylla*) and Dahurian Rose (*Rosa dahurica*) form only an insignificant admixture in the very rich dense undergrowth. Due to plenty of light in such sparse forests the ground is covered with an excellent carpet of herbs, nearly 60 species, for instance *Atractylodes ovata*, *Adenophora latifolia*, *Iris uniflora*, *Vicia pseudorobus*, *Lathyrus humilis*, *Carex nanella*, etc. Bare parts of the ground and near-by bases of oak-trunks are usually covered with mosses.

In undersized Amurland oak-groves Forest Wagtails find very favourable conditions for breeding: the trees stand far from each other, the peculiar structure of the crown of the Mongolian Oak is very convenient for nest construction, the large oak leaves provide the nests with excellent camouflage, there is plenty of building material everywhere, and plenty of insects and other small invertebrata for food. It is necessary to note that only the Grey Minivet (*Pericrocotus divaricatus*), among other small passerine birds living in oak-groves, finds optimal living conditions there. No birds breeding on bushes live in the underbrush of the Mongolian Oak groves. The reason is that the structure of Lespedeza and Dahurian Rhododendron is inconvenient for nest construction. In Amurland near the Simonovo village, besides the birds mentioned above (the Spotted Tree Pipit, Yellowbacked Flycatcher, Grey Minivet, Needle-tailed Swift, Owlet), a few more species were recorded by me in the oak-groves: the Great and Lesser Spotted Woodpeckers (*Dryobates major* and *D. minor*), the Willow Titmouse (*Parus atricapillus*), the Nuthatch (*Sitta europaea*), the Goshawk (*Accipiter gentilis*), and the Siberian Capercaillie (*Tetrao parvirostris*). If we exclude the Goshawk and the Siberian Capercaillie as non-characteristic of such biotope, only ten species of birds can be considered as typical inhabitants of the Forest Wagtail's biotope. In comparison with other types of

local forests the upper Amur oak-groves have the poorest population of birds, as regards both number of species and density of population. Many oak trees are rotten inside, and hollow trees are very common. Owing to this the hollow-breeding birds are predominant over other species of birds there.

According to Spangenberg's observations (1940, 1949) at the Iman River in Ussuriland, Forest Wagtails are inhabitants of sparse oak-groves on slanting hill slopes. Shulpin (1931a) considers oak forests with an admixture of birches (*Betula costata* and *B. dahurica*), lime trees (*Tilia amurensis*), and an undergrowth of Lespedeza and hazel bushes as a main biotope in south Ussuriland. Oak groves are also the breeding biotope of this species in Sakhalin Island (Gizenko, 1955).

Such conservatism in the selection of breeding biotopes is the main cause of the unevenness of the distribution of the species within the limits of its breeding range. For instance, large territories along the lower course of the Iman River in Ussuriland are covered with oak forests, and the Forest Wagtails are widely distributed there. Contrary to this these birds occur sporadically along the middle course of the river where there is a spotted distribution of the oak-groves (Spangenberg, 1949). In the upper Amur area the authoress never met Forest Wagtails in small isolated oak groves, though the birds were abundant near by in oak groves occupying large territories.

It is interesting to note that in the territory investigated by the authoress the density of population of Forest Wagtails was rather high, and some pairs lived in Dahurian Birch forests covering terraces in glens. In appearance these Dahurian Birch forests are very similar to oak-groves due to the same construction of the crown of the trees. Like in the oak-groves there is, under the foliage canopy, dense underbrush composed of Lespedeza and hazel bushes, and rich herbage of *Convallaria majalis*, *Thalictrum minus*, *Aster scaber*, *Iris uniflora*, *Adenophora latifolia*, *Atractylodes ovata*, etc.

Behaviour and Song[1]

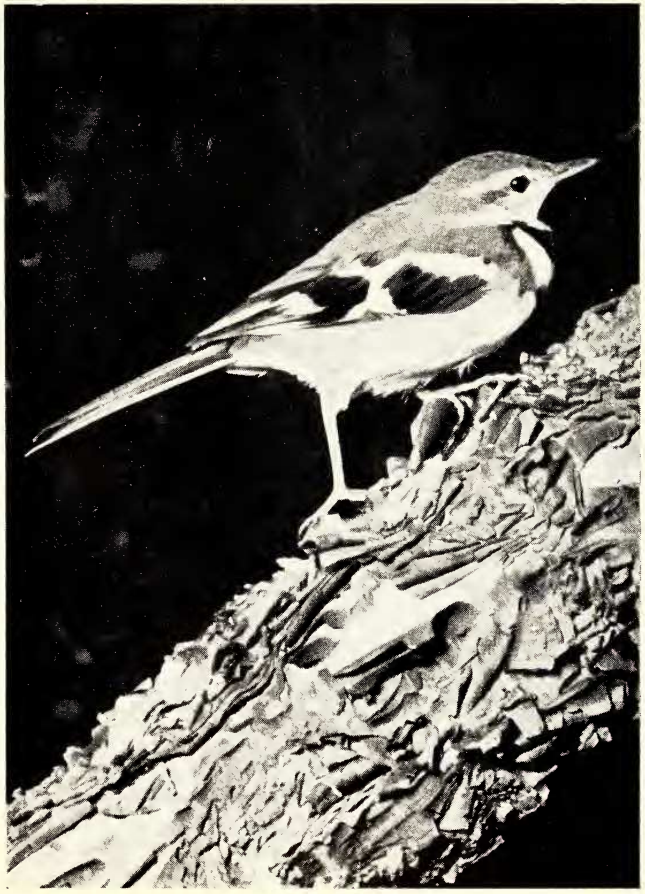
Males sing regularly throughout the breeding period. In 1959 the authoress recorded their songs from 27th May to 10th July. They sang especially intensively before the beginning of nest-building, i.e. from 27th May to 7th June. They were active during daytime, a

[1] The song of the Forest Wagtail was described in detail by Hoffman (1952).

little more in the morning, less at midday. According to observations made in the environs of Simonovo village on 28th May 1959 males began to sing at five in the morning, and on 5th June at five past four in the morning. They became silent only at sunset, i.e. in June approximately at half past twenty hours. According to Hoffman (1952) in Nanking (China) the Forest Wagtails at the beginning and at the middle of May began to sing approximately at 6 in the morning; on 28th May at 5.40 a.m.; on 1st June they sang with intervals from 5.35 a.m. till 8 p.m.; on 4th June males began to sing at 5.30 a.m., and on 9th June at 5.15 a.m.

The song is very simple but rather sonorous, and can be heard from far away. It is somewhat like the song of the Great Tit (*Parus major*), being composed of the disyllabic strophe *tsi-fee*. Usually the male repeats its *tsi-fee* four or five times without a break; sometimes, as if in haste, it includes in its song only two or even only one strophe. The same male may use different variations of the song, usually the long song, very seldom a short one. The male has no favourite place for singing in its breeding territory where it could be seen. Early in the morning at the time of maximal activity some males sing perched on a dead twig at the very top of a high tree (usually birch or aspen). The rest of the time they usually keep at a moderate height in the crowns of oaks or Dahurian Birches. At the period of highest excitement males do not cease singing even while they fly from one tree to another. The authoress has not seen any song-flight in the Forest Wagtails. In spring, at the end of May, males in migrant flocks sang intensively while running on the ground in search of insects. At intervals between songs males emit a call *clink, clink*. Both males and females utter this call as an alarm when frightened and also as a signal to the others when beginning a flight. Many ornithologists who have had the opportunity to observe Forest Wagtails either in the breeding season or in their winter quarters compare this call with the well-known call of the Chaffinch: *chwink, chwink*. In Sálim Ali's (1953) opinion this call of the Forest Wagtail resembles very much the call of the Crested Bunting (*Melophus lathami*). When very much alarmed, Forest Wagtails utter another, more prolonged call: *tsee-fee-ten*.

With the beginning of nest-building (in the south-western portion of the Amur-Zeya plateau after 7th June in 1959) the intensity of males' songs markedly diminished. They could be heard all day, but at long intervals especially towards evening. Males continued to sing near their nests after the full clutches were completed and even



Above. Nest of Forest Wagtail *(Motacilla indica)* in oak tree

Left. Forest Wagtail *(Motacilla indica)* running along inclined branch of Dahurian Birch

(*Photos : Irene Neufeldt*)

Above. Two-weeks-old nestling of Forest Wagtail *(Motacilla indica)*

Left. Forest Wagtail *(Motacilla indica)* at rest

(*Photos : Irene Neufeldt*)

when the nestlings hatched out, but very irregularly. Singing ceased with the end of the nestling period.

Among mimicking birds in Amurland, the Brown Shrike (*Lanius cristatus confusus*) very often and very well reproduces the Forest Wagtail's calls and song. Several times in 1959 the authoress heard a male Brown Shrike which included in its own song phrases adopted from seven species of birds: the Spotted Tree Pipit (*Anthus hodgsoni*), Whitethroated Rock Thrush (*Monticola gularis*), Blacktailed Hawfinch (*Eophona migratoria*), Radde's Bush Warbler (*Phylloscopus schwarzi*), Wryneck (*Jynx torquilla*), Indian Cuckoo (*Cuculus micropterus*) and, distinctly and loudly, the Forest Wagtail.

The singing male, whether running or standing in one place, sways as if in time with its song. To every syllable of the song corresponds the inclination of the bird's body, to one side or the other. Such lateral pivoting of the body is also habitual with females, and even with young birds recently fledged. This peculiarity was the reason of the Japan name of the bird, *Jokofury-sekirei*, i.e. Sideways-swinging Wagtail (Austin, 1948). Unlike other wagtails and pipits the Forest Wagtails never swing their tails in the same way[1].

The Forest Wagtail is the only member of the large family Motacillidae which builds its nest in trees. At the first acquaintance with this very graceful and lively bird the observer is struck by the wonderful ability of the bird to run very fast and easily along horizontal branches of different thicknesses. Without any visible difficulty they can climb or descend steep inclined branches (Plate I). Within their small nest-territory they usually move on foot, flying only from one tree to another, or between a tree and the ground. Unlike woodpeckers, tree creepers, and nuthatches, Forest Wagtails have no special adaptations for tree-living. In comparison with other wagtails, the legs are a little shorter and the claws, including those of the hind toe, are sharp and strongly curved.

At breeding time Forest Wagtails spend plenty of time in the crown of the trees. Numerous and prolonged observations showed that the birds can run with ease along comparatively narrow and steeply inclined branches when the bark is very rough, but not if it is very smooth. In Amurland, as in other parts of the range, oaks and Dahurian Birches serve excellently for this purpose, as well as for nest building.

As far as is known from literature, on migration and in winter quarters Forest Wagtails keep mainly on the ground. Only when

[1] except very slowly up and down while pivoting from side to side on a branch. —S.A.

disturbed they fly on to the nearest tree, run some distance along a thick horizontal branch, and fly down very soon. No preference for any definite kind of trees has been noticed at that period of its life.

Nest

In Amurland in the region of the authoress's study in 1959 the majority of Forest Wagtails had begun to construct their nests by 6th June. On 7th were met birds which had just started nest building, and on 8th and 9th June were recorded five pairs whose nests were nearly complete. At the same time (on 9th June) there were full clutches in two nests. The female alone builds the nest, with building material which she collects from the ground. Usually she visits many times a selected place which abounds in building material. At the beginning of June in Amurland oak forests one frequently comes across a number of Forest Wagtails flying in the same direction with large bunches of moss, rotten leaves, or grass in their beaks. Cautiously tracing such a bird it is easy to find a nest in course of building. The male takes no part in nest building, but is constantly somewhere near by; he accompanies his mate when bringing the building material, and is the first to notice and warn her of danger. The female is very cautious and never flies directly to the nest, even when it is building; she perches on a lower branch of a near-by tree and only after an assuring 'all clear' call from her mate does she fly to the nest-tree, running inconspicuously along the branches to the nest.

If disturbed at an early stage of nest building, the female abandons the nest and, soon after, begins to look for a new site. Later, when the nest is nearly completed, the birds become less shy and do not stop building even after a short visit by the observer.

At breeding time, as in the early period after their coming back from winter quarters, Forest Wagtails prefer the marginal and lightest parts of the forest and avoid the inner dense and high-standing parts. In all the cases known to the authoress the nests were built on medium-sized trees (5-17 m. high) growing near forest ways and vistas.

From Table I the preference given to oaks for nest building is evident. The same took place in Ussuriland (Spangenberg, 1949; Vorobiev, 1954) and east China (La Touche, 1930).

TABLE I

Position of the Nests

Serial No.[1]	Kind of tree	Height above the ground	Distance from the main trunk	Diameter of the branch supporting the nest
1	oak	7-8 m.	2.5 m.	69 mm.
2	oak	5-6 m.	3.0 m.	87 mm.
3	oak	6 m.	1.5 m.	66 mm.
4	oak	10 m.	2.0 m.	66 mm.
5	Dahurian Birch	5 m.	0.0 m.	62 mm.
6	oak	6.5 m.	0.0 m.	68 mm.
7	oak	4.5 m.	0.0 m.	..
8	oak	5.5 m.	2.5 m.	..
9	oak	4 m.	1.5 m.	..

[1] We retain these numbers throughout the text.

Horizontal branches not very thick (66-68 mm. in diameter) are very convenient for nest building. The birds usually select for building the distal part of the branch 1.5-3.0 m. away from the main trunk. A horizontal branch a little thicker than the internal diameter of the nest-cup (Table II) is a safe support, and ensures a firm position for the rather friable nest. Short additional twigs of the branch support the nest from the sides (Plate III, fig. *a*, *b*, *c*). Most of the known nests were located in the same way. Sometimes the birds use vertical verticils, either at the end of thick inclined branches at a significant distance from the trunk (Plate IV, fig. *d*) or at the top part of the trunk (Plate IV, fig. *e*, *f*). The nests observed in Amurland were built at a height of 4 to 10 m. above the ground. In some cases Forest Wagtails build their nests at smaller height, only 3 or even 1.5 m. above the ground.

For the construction of the nest walls the Forest Wagtails in Amurland use dry blades of grass, dead leaves, small pieces of bark or separate fibres of bark, small roots, and sometimes wool of rodents (*Pteromys volans* and *Microtus* sp.). On the outside the nests were faced with stems of green mosses, cocoons of spiders covered with small particles of soil, dead leaves, and slender little stalks. The nest built in the Dahurian Birch was decorated with numerous small papery pieces of the Asian White Birch bark. The second nest, built near the expedition camp, was ornamented with cotton wool.

The nests are so carefully and skilfully incrusted with these materials that they are hardly visible against the background of the dark bark covered with light spots of lichens. Sometimes, even at a very short distance, it is impossible to recognise the limit between the branch and the nest wall (Plate I). The cup is usually plentifully lined with thin roots and wool of the Roe Deer (*Capreolus capreolus*). Besides that, there are inside nearly each nest one or two feathers of the Hazel Grouse (*Tetrastes bonasia*), or the Ussurian Scops Owl (*Otus sunia stictonotus*), or any small passerine bird. Horse-hair, the very common lining of Forest Wagtail nests in Ussuriland and China, was recorded by the authoress in one nest only. The reason for this is the remoteness of the area of observation from human settlements. The measurements of the nests taken by the authoress appear in Table II.

TABLE II

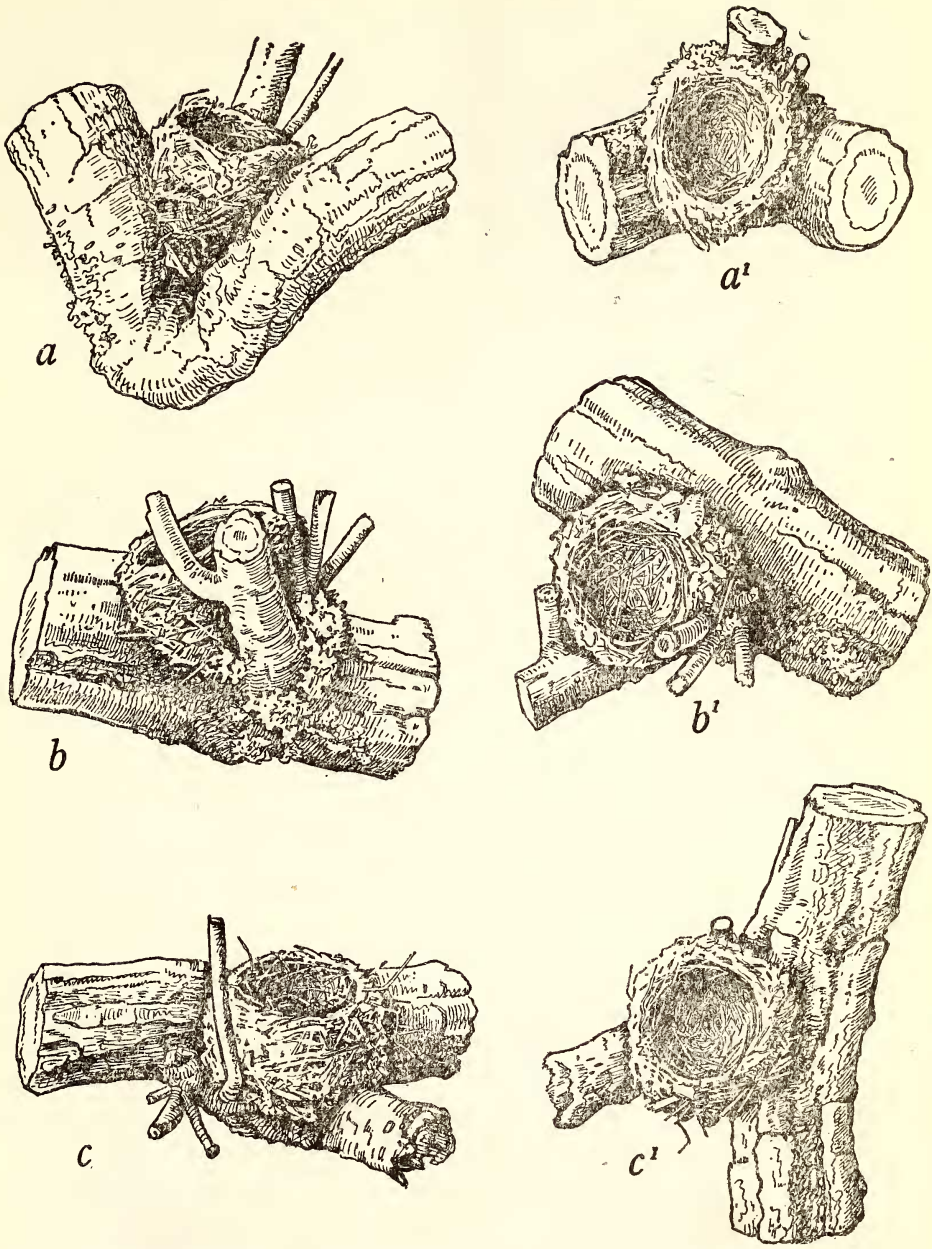
Nest Measurements

Serial No.	External height in mm.		External diameter in mm.	Internal diameter of cup in mm.	Internal depth of cup in mm.
	max.	min.			
1	74	34	86	51	34
2	70	45	91	60	40
3	80	75	88	51	40
4	62	30	91	65	40
5	89	82	84	52	42
6	61	50	87	63	35
7	60	48	90	58	33

These measurements coincide with the measurements given by Spangenberg (1949) and Vorobiev (1954) for Ussuriland. Only the external height is more variable, in accordance with the position of the nest. For instance, before the birds were able to build the nest No. 5, they had to fill with material the narrow space between the bases of the twigs in order to prepare the basement for the nest proper.

BREEDING SEASON AND EGGS

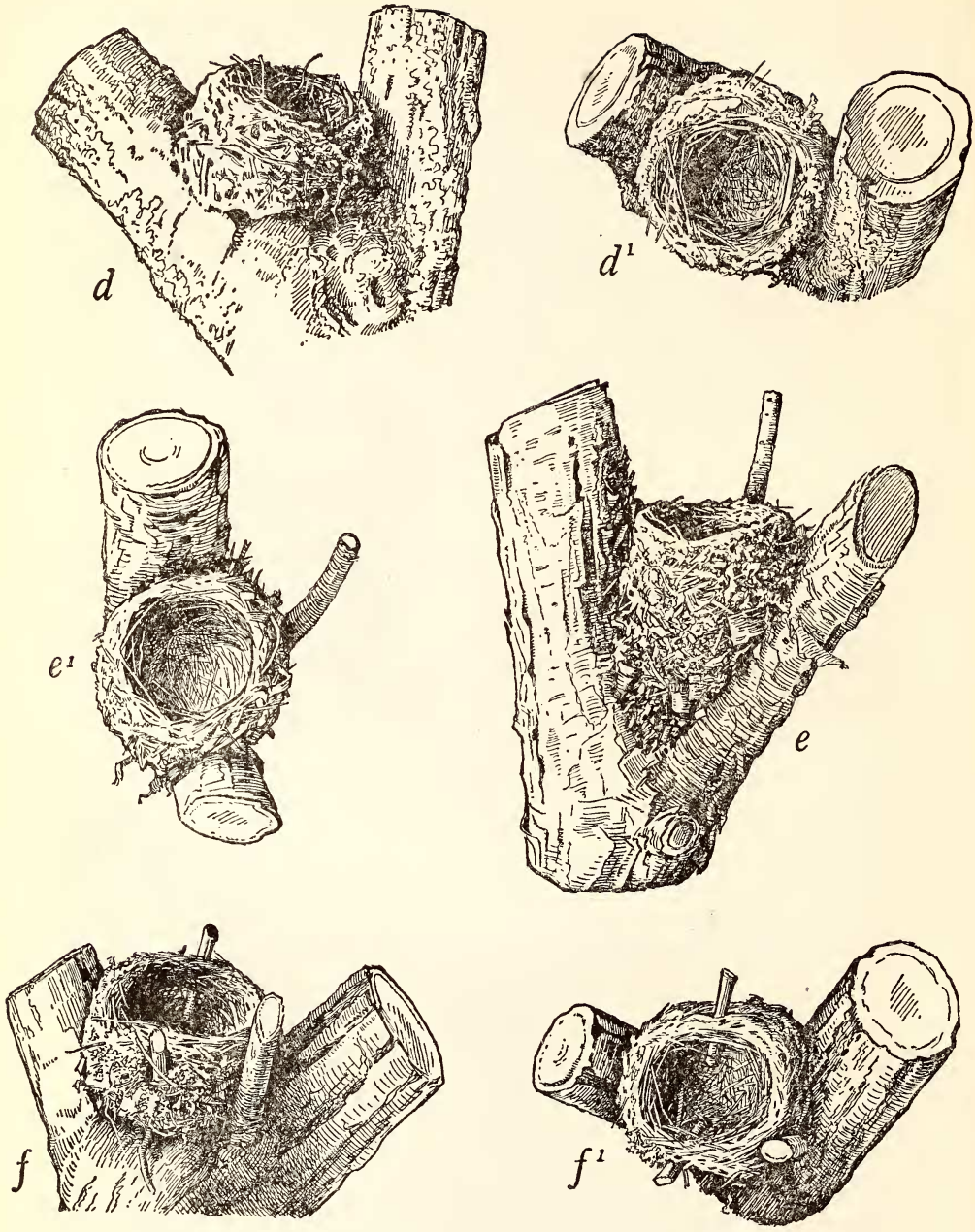
Arriving late in their breeding range the Forest Wagtails have time to breed only once. In most parts of the breeding range they



Nests of Forest Wagtail (*Motacilla indica*) on horizontal branches of oak

a,b,c : from side; a,' b', c' : same nests from above

(*Drawn from nature by V. Rozhdestvenskaya*)



Nests of Forest Wagtail (*Motacilla indica*)

d : on end verticil of inclined branch of oak ; e : on vertical fork of main trunk of Dahurian Birch ; f : on vertical fork of main trunk of oak ; d′, e′, f′ : same nests from above

(*Drawn from nature by V. Rozhdestvenskaya*)

begin to lay the eggs in the first half of June. According to the literature the following can be said about the breeding season. In the suburbs of Peking on 2nd July the young were leaving their nests. In Anhwei province on 8th June 1910 was found a nest with four eggs, and on 21st June with two eggs (La Touche, 1930). In Korea (Pyongan Namdo) Won collected on 3rd June 1938 a nest with five eggs (Austin, 1948). In southern parts of Ussuriland fresh eggs were recorded on 8th June 1939 (Spangenberg, 1949), and on 10 and 11th June 1946 (Vorobiev, 1954). In the collection of the Zoological Institute of the Academy of Sciences in Leningrad there are seven nestlings (14-15 days old) collected by Shulpin in the Pkhusun river valley (Ussuriland) on 5-9th July 1927. In the nests we found in Amurland the first eggs were laid: in two nests on 6th June, in two nests on 9th June, in four nests on 11-12th June, and in one nest on 17th June. The last was a case of second laying after the first slightly incubated clutch was destroyed. Spangenberg's record (1949) of nestlings on 6th June 1948 in the Iman river valley (Ussuriland) seems doubtful. It would only be possible in case the eggs were laid not later than 19th May, i.e. at an extremely early date.

The interval between nest-completion and egg-laying is one or two days. In one nest which was kept under permanent observation, attendance at the nest by the egg-laying female was recorded from 4.20-4.30 hours and again from 6-7 hours. After the egg was laid the bird stayed at the nest for some time and then flew away till the next morning. Incubation begins after the last but one egg is laid. In a case with a full clutch of six eggs the female began incubation after the fourth egg was laid. The normal clutch consists of 4 or 5, and seldom of 6 eggs. In cases of late (repeated) laying the clutch consists of 3, or even only 2 eggs.

Variation in size of eggs in the same clutch as well as in different clutches and from different parts of the range is very small. This is evident from the comparison of data from Ussuriland and Amurland (Table III), China (La Touche, 1930), and Assam (Stuart Baker, 1934).

In coloration Forest Wagtail eggs closely resemble a very common European variation of Chaffinch eggs, and sometimes the eggs of the Spotted Tree Pipit (*Anthus hodgsoni*). They have a dirty-bluish ground coloration with very sparse large grey spots concentrated principally near the blunt end of the egg. Small grey spots are distributed evenly all over the surface of the egg. Besides this, dark brown speckles, sometimes with vague rusty margins and roundish

black-violet surface spots, cover the shell surface irregularly. In only one clutch were the eggs of another type of coloration: light greenish-blue ground covered with comparatively small, very indistinct brownish-grey spots, more dense near the blunt end.

The behaviour of incubating females on approach by man to the nests was varied. In some cases the female silently flew down nearly brushing the man, and then began to attract the enemy away by flying low above the ground and imitating the movements and voice of a wounded bird. In other cases the female sat in the nest very firmly and left it only when the observer began to climb up the tree and shook it. Thereafter it perched somewhere in the lower part of the crown of the tree and gave an alarm call, whereupon it was joined by its mate and sometimes other Forest Wagtails living near by.

The male always feeds its mate in the nest. Now and then the hen leaves its nest in search of food. Silently and unobtrusively it comes back to the nest, running the last part of its way along branches among dense foliage.

Nestlings, the Life of Broods, Autumn Migration

The incubation period of Forest Wagtails is 13 days. As incubation begins before the clutch is completed, the hatching of all the nestlings of the brood is not simultaneous. In fact, the female incubates for 14 or even 15 days, and the last nestling hatches one or two days later than the first ones. In nests examined in the upper Amur Valley the hatching took place from 26th June to 4th July. No addled eggs were recorded. All 39 eggs in these nests were fertilised; from 36 the nestlings hatched safely, and 3 were stolen from the nest probably by Chipmunks (*Tamias sibiricus*).

Immediately on hatching the young are blind, acoustic ducts closed, and body naked with sparse golden-grey neossoptiles above the eyes and on eyelids, nape, back, femurs, shanks, vent, shoulders, forearms (humeral region), and inner side of hand (carpal region). It is necessary to note that the nestlings of no other Motacillidae have neossoptiles on their hands. The skin on the body of a recently hatched nestling is yellowish pink, the mouth is orange-yellow, and the tongue is yellow with a grey fringe near its base. The bill is greyish with light yellow side protuberances. The weight of the hatchling is 1.7-1.9 grammes.

At the end of the first day of the nestlings' life the pterylae or feather tracts can be noticed in the form of dark areas on the dorsal

TABLE III

Egg Measurements

Locality	Serial No. of Nest	Egg Number	Absolute size (in mm.)		Average size of eggs belonging to clutch (in mm.)
			Length	Breadth	
Amurland, Neufeldt (1960)	1	I	19.2	15.0	19.1 × 14.7
		II	19.2	14.7	
		III	19.2	14.5	
		IV	19.0	14.7	
	2	I	21.5	15.0	20.6 × 14 8
		II	20.7	15.0	
		III	20.2	14.8	
		IV	20.0	14.5	
	3	I	21.5	15.3	20.9 × 15.6
		II	20.7	15.5	
		III	20.6	16.0	
	4	I	19.3	15.0	18.9 × 14.9
		II	19.2	15.2	
		III	19.0	15.0	
		IV	19.0	15.0	
		V	18.5	14.3	
		VI	18.3	14.6	
	5	I	19.5	14.7	19.2 × 14.9
		II	19.0	15.0	
		III	19.0	15.0	
		IV	19.3	14.8	
		V	19.3	14.8	
Ussuriland, Spangenberg (1949)		I	21.0	15.0	21.0 × 14.8
		II	21.1	14.8	
		III	21.2	14.8	
		IV	20.6	14.7	
		V	21.1	14.5	
Ussuriland, Vorobiev (1954)		I	19.1	14.2	19.5 × 14.4
		II	19.0	14.4	
		III	19.3	14.4	
		IV	20.0	14.4	
		V	20.3	14.6	

and partly on the ventral sides of the body. Sometimes on the second day appear the tiny needles of growing remiges. In three-day-old nestlings the acoustic ducts open, the eyes are like narrow slits, the growing primaries are about 1 mm. long, needle-like ends of growing rectrices are faintly visible, and the first feathers appear on the dorsal side of the neck. On the fourth day the feathers on the shoulders and neck begin to unfold. Next day unfold the feathers

of the back, breast, and secondary coverts. In five-day-old nestlings the eyes are nearly entirely open, and their second primaries are 5-8 mm. long. On the sixth day nearly all contour feathers unfold, as far as the ends of the primaries and secondaries. The week-old nestling weighs eight times more than a newly hatched one.

In the first days of their life nestlings of the same age and of the same brood can have slight individual differences in their weight. Some days later the differences become less noticeable. For instance, in one brood the weights of three hatchlings were: 1.7, 1.9, and 1.9 gr. The weights on subsequent days were as follows:

1 day old :	3.0,	3.0,	3.2 gr.
2 days old :	4.9,	4.9,	5.5 gr.
3 days old :	6.3,	6.4,	6.9 gr.
4 days old :	8.3,	8.5,	8.6 gr.
5 days old :	10.2,	11.0,	11.2 gr.
6 days old :	11.0,	11.7,	11.6 gr.
7 days old :	14.3,	14.5,	14.5 gr.
10 days old (just before leaving nest) :	17.0,	17.0,	17.2 gr.

It is evident that the differences in weight become progressively less noticeable.

The case is somewhat different with nestlings hatched one or two days after other nestlings of the same brood. For instance, in one nest the fourth nestling hatched one day later than others. Just after hatching it weighed 1.7 gr., when it was one day old 3.0 gr., two days old 3.8 gr., four days old 6.5 gr., five days old 8.0 gr., six days old 9.7 gr., seven days old 12.5 gr., ten days old 15.3 gr. On the first two days of its life this nestling was of the same weight as its brood-mates. But it was younger, and it is common in birds that elder nestlings receive more food than the younger ones. For this reason the difference in weight between it and its brood-mates sometimes rose to 3.2 gr. It is necessary to note that in none of the nests which were under everyday observation was there registered any influence of such difference in weight upon development of feathers, acquirement of sight, etc.

Sometimes on the ninth, and as a rule on the tenth, day of their life, nestlings begin to jump out of the nest on being disturbed by the observer. In normal conditions they leave their nest on the eleventh or even on the twelfth day. Owing to difference in age the younger nestlings may leave the nest one day later than the elder ones.

The total nesting period, from the laying of the first egg to the leaving of the nest by the last nestling, is 28-30 days.

Nestlings, just after they leave the nest, are rather well feathered. To the age of 14 days solitary down feathers can still be noticed on the head and the back. Nestlings which have just left the nest weigh 17.2-18.0 gr., i.e. the same as their parents (♂♂ 17.2-18.4 gr., ♀♀ 17.7-18.9 gr.).

During the first two or three days the brood remains at a very short distance from its nest in spite of the young being able to flit rather easily from one branch to another. From the age of 17-18 days the young birds become able to fly fairly strongly. Like the adults they spend much time in the crown of the trees, where they run without any difficulty along horizontal and inclined branches of different thicknesses. A tame young Forest Wagtail, which lived in our camp in 1959, preferred to climb to the shoulder of a sitting man 'on foot' in spite of being able to fly quite well. On its way it made full use of all creases in the cloth. Frequently the young birds descend to the underbrush following their parents searching for food on the ground. But very often, before they begin to search for their food independently, they keep themselves in the lower parts of the crown of the trees. Fully plumaged young birds are on the whole similar to the adults. The difference is in the predominance of greyish and brownish shades on the upper parts of young birds; moreover the double band across the breast is not so distinct and broad as in adults (Plate II).

For some time after leaving the nest young birds keep in families, but very soon they become independent and broods disintegrate (from the middle of July on the upper Amur). Adult birds keep in pairs or solitary in oak groves, and the young belonging to two or three broods unite in small flocks and migrate to the outskirts and thinned-out parts of the wood. Here, Spotted Pipits, nuthatches, and tits are often seen in company with flocks of young Forest Wagtails. Being very silent, the Forest Wagtails are hardly noticeable at that period.

Males and females take an equal share in feeding the young. Spiders, small grasshoppers, butterflies, beetles, and large cicadas were recorded as food at that time. In Amurland during nearly all the summer, cicadas and their moulting nymphs predominated in the diet of the adult birds. They search for food preferably on the ground, picking up insects from grass, forest litter, bases of tree trunks, lower branches and leaves of bushes. According to the literature, in other parts of the area and in winter quarters Forest Wagtails pick up